

Remarks

Claims 2-3, 6-19, 22, and 24-26, 28-29, 31-32 and 36 are pending in the application. By this Amendment, claim 4 is canceled without prejudice or disclaimer and claims 2 and 36 are amended. These amendments contain no new matter.

The outstanding Office Action rejected claims 2-4, 6-19, 22, 24-26, 28-29, 31-32 and 36 under 35 U.S.C. § 101 as allegedly inoperative and therefore lacking utility for the same reasons set forth in section 3 of the May 19, 2004 Office Action and section 2 of the outstanding Office Action. (Dec. 11, 2003 Office Action at 5.) This rejection is respectfully traversed.

The Office Action also rejected claims 2-4, 6-19, 22, 24-26, 28-29, 31-32 and 36 under 35 U.S.C. § 112, first paragraph, asserting that the Specification does not describe the claimed invention in such a way as to enable one skilled in the art to make and/or use the invention for the same reasons asserted with respect to the rejection under 35 U.S.C. § 101. This rejection is respectfully traversed.

The Office Action also rejected claims 2-4, 6-19, 22, 24-26, 28-29, 31-32 and 36 under 35 U.S.C. § 112, second paragraph, as being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter which Applicant regards as his invention(s) for the same reasons asserted with respect to the rejection under 35 U.S.C. § 101. This rejection is respectfully traversed.

I. THE CLAIMS ARE ALLOWABLE UNDER 35 U.S.C. §§ 101 & 112

In the Office Action, the same (or substantially the same) bases are asserted for rejection of the claims under 35 U.S.C. § 101, under 35 U.S.C. § 112, first paragraph, and under 35 U.S.C. § 112, second paragraph. Accordingly, Applicant will respond to the rejection of the claims under 35 U.S.C. § 101, under 35 U.S.C. § 112, first paragraph, and under 35 U.S.C. § 112, second paragraph,

together. Applicant respectfully traverses the § 101 rejection, the § 112, first paragraph, and § 112, second paragraph, rejections for the reasons discussed below.

A. Applicant has filed reliable evidence supporting both the underlying principles upon which this invention is based and the operability of the invention itself

The outstanding Office Action asserts that the claims of this application lack utility, asserting that the invention defined therein relates to cold fusion. The various office actions have cited a number of articles and reports which argue that cold fusion does not work. The claimed inventions do not relate to cold fusion. The energy released by the method of the claimed inventions is a direct result of the energy emitted when an electron drops from a higher electron orbit to a lower electron orbit. Although the written description refers in part to energy released from fusion, the amount of fusion energy produced is nominal compared with the energy released when the electron drops to a lower energy level.

In more detail, the claimed inventions harness the energy emitted from a hydrogen or a deuterium atom when the electron in the atom drops from the ground state to a sub-ground state. Applicant has previously filed a report written by Prof. Lino Daddi and Prof. Elio Conte, confirming that the existence of sub-ground energy levels is accepted by scientists skilled in this field. Prof. Daddi and Prof. Conte each have substantial experience in the field and are well respected figures. The resumes for Profs. Daddi and Conte were attached to the report previously filed, and they demonstrate that these two professors are experts in their field. The report was not commissioned to repeat the method described by the present application and does not, as noted at page 3 of the outstanding Office Action, describe any specific apparatus. Instead, the report was provided as background information confirming the scientific principles exploited in the method of the claimed

inventions. The report gives independent evidence that a significant proportion of the scientific community accept that sub-ground energy levels exist.

The outstanding Office Action contends that the reliability and the validity of the conclusions reached in the report of Daddi and Conte may not have a firm basis since the report has not been published and has not been subjected to peer review. However, the report refers to the findings of a number of references that have been published in widely circulated technical journals such as Physics Letters A, Europhysics Letters, Physics Review and Fusion technology, or at conferences. These references set out experimental and theoretical results obtained by a number of leading scientists in this field.

For example, on pages 15 to 17, the results of Maly and Vavra are discussed, which results show that Schrodinger's relativistic equation and Dirac's equation are satisfied for more compressed hydrogen like atoms, thus supporting the existence of more compressed atomic structures. The results of J. P. Vigier, which were published in Physics Letters, are discussed on pages 17 to 18. Vigier used Schrodinger's Hamiltonian equations to show that, in condensed matter, electrons in hydrogen and deuterium may exist in compressed orbits. Other theoretical results are also discussed in detail in the Daddi and Conte report.

In addition, the report identifies a number of experiments, the results of which agree with the theoretical results. For example, page 9 briefly describes C. Borghi's experiment in which a large quantity of neutron-like particles were observed. These results were confirmed by Conte and Pieralice. Upon analysis by L. Daddi, it was found that the observed particles were not neutrons, but that the particles were consistent with compressed hydrogen atoms. As mentioned at page 10, Mills and Good used X-ray photoelectron spectroscopy to demonstrate an electron energy level of $n=1/2$ in a hydrogen atom. Various other experimental results are also discussed in the report.

The references themselves discuss complex quantum physics and are aimed at readers with detailed knowledge in the art. It is therefore felt that the Daddi and Conte report summarizing these findings is a more manageable form of evidence in this case.

Accordingly, the Daddi and Conte report does not merely represent the opinion of two people, but gives reliable and reputable support for the existence of sub-ground energy levels based on subject matter which has indeed been published and subjected to peer review.

In addition to providing evidence that the scientific principle upon which this invention is based is accepted by at least part of the scientific community, Applicant has also filed independent evidence that the method of energy release described in the application works in practice. The report by Dr. Jason Riley of Bristol University sets out results obtained by an experienced experimentalist when implementing the method of the present application. Applicant respectfully submits that such a report evidencing independent experimental results need not be published and subjected to peer review for it to be considered reliable evidence. The report does not provide a discussion of Riley's own opinions or theories, but it contains statements of fact relating to experimental steps carried out and results obtained. Dr. Riley's competence as an electrochemist is evidenced in his appointment at a reputable British university and also from his resume, a copy of which is attached. Applicant therefore respectfully submits that Riley's report provides sound evidence as to the results obtained when carrying out the method described by him.

In this regard, the outstanding Office Action alleges that the method and apparatus described by Riley is not consistent with that of the present application. To the contrary, Applicant respectfully submits that the experiments carried out by Riley were carried out using apparatus described in the present application in accordance with the method described in the application.

Firstly, the outstanding Office Action asserts that the electrochemical cell used by Riley is different to that described in the application since Riley describes a single container cell whereas the application describes a dual-container cell. Figure 1 of the application shows a beaker for containing the electrolyte and an insulating quilt 6. Although Riley's Figure 1 does not depict an insulating layer, this is described in the second paragraph of page 2 of the report. Accordingly, the electrochemical cells of the application and of Riley's report are the same in this respect.

The outstanding Office Action also alleges that Riley shows a vent penetrating the interior of his cell, whereas the application does not disclose a vent. It is known that electrolysis of water releases oxygen and hydrogen in accordance with Faraday's law and that steam is released when water is heated to its boiling point. The release of oxygen and hydrogen gas, or steam, will increase the volume or, in a sealed vessel, the pressure. It is therefore customary practice to provide a vent for the gases to avoid the dangerous build-up of pressure. This detail was not shown in Figure 1 of the application since an electrochemist would see this as an inherent inclusion in this apparatus. In any case, the application describes, in the paragraph spanning page 3 and page 4, extracting pressurized steam from the apparatus and using this to produce further electricity. This would necessarily involve the provision in the cell of an outlet for gases. Applicant therefore respectfully submits that Riley and the description in the present application do not vary in this respect.

The outstanding Office Action further asserts that Riley does not provide dimensions for the electrodes. On the contrary, Riley states that the cathode is a sharp tungsten wire and that the anode is a platinum plate. This is in accordance with page 14 of the application. The application further states that the length of the tungsten wire was between 10mm and 20mm and that the area of the platinum plate was approximately 10mm². These are standard dimensions when using wire and plate electrodes in a small scale apparatus. The small size of the apparatus does not allow for wide

variations in the length and area of the electrodes. Further, the exact length and area of the electrodes does not affect whether, or how the method works. Instead, it affects the output duty of the system. Applicant therefore respectfully submits that the electrodes used in Riley do not differ from those used in the present application in any way which could affect whether or not the claimed invention is operable.

The outstanding Office Action alleges that the electrolyte concentration in Riley is different from that used in the Applicant's method. The present application describes on page 3 a catalyst concentration of between 1 and 20 mMol, and on page 14 a concentration of approximately 2 mMol. Riley discloses under point 5 of his report a catalyst concentration range of $1-20 \times 10^{-3} \text{ mol dm}^{-3}$, which is equivalent to 1 to 20 mMol. Accordingly, the present application and Riley are consistent in this respect.

In view of the above remarks, Applicant has addressed each of the outstanding Office Action's objections regarding the two reports filed with Applicant's previous response, and therefore respectfully submit that Applicant has filed reliable evidence supporting both the underlying principles upon which this invention is based and the operability of the invention itself.

B. The claimed inventions are patentable under 35 U.S.C. § 112

With reference to section 5 of the official action dated 23 September 2002, the outstanding Office Action raised further questions with regard to the theoretical disclosure on pages 4 to 9 of the description. The disclosure on these pages explains the inventors' belief relating to the theory explaining the mechanisms by which the claimed inventions operate.

As explained above, the claimed inventions utilize the fact that energy is emitted from an atom when an electron in that atom decays to a lower energy level. Many of the questions posed by the outstanding Office Action or prior official actions find their answers in the theory associated

with the movement of an electron from an excited state such as $n=3$ to a lower energy level such as $n=2$. Since Applicant has established above that fractional energy levels are accepted in the scientific community, the same principles apply to the transition between $n=3$ and $n=2$ as do to $n=1$ to $n=1/2$. Nevertheless, Applicant addresses below each of the objections raised by the outstanding Office Action with respect to the disclosure on pages 4 to 9 of the description.

1. How and in what manner does the catalyst produce the transitions?

The catalyst provides the hydrogen/deuterium atoms with a receptor site for the energy emitted when the electron decays to a lower ground state, as described at the end of page 8 of the application. The transfer of energy occurs when a hydrogen atom collides with a catalyst particle. The hydrogen atom gives up energy to the catalyst. Accordingly, the electron in the hydrogen atom must drop down to an energy state which is lower than the ground state.

2. The disclosure does not provide technical support for the claimed existence of said “sub-ground energy state”?

This has been addressed in the remarks above.

3. The disclosure does not adequately justify that fractional values of n are allowed and insufficiently describes the conditions to be met in order that fractional values of n would be allowed?

The Rydberg equation, using the Rydberg constant of proportionality, is accepted as giving stable non-radiative states. $n=1$, $n=2$ etc. are calculated as being stable energy levels using the Rydberg equation, and the equation is also satisfied for fractional energy levels. Providing the Rydberg constant may be relied upon, and in this regard, Applicant respectfully submits that the validity of this constant of proportionality is beyond doubt in the minds of all persons of ordinary skill in the art, this confirms the existence of fractional energy levels.

4. What is meant by “effective nuclear charge” and what is the basis for it being a multiple of Z ?

The nuclear charge is the actual amount of charge in the nucleus. However, the charge felt by an electron in an orbit around a nucleus varies inversely with the square of the distance between the nucleus and the electron. Accordingly, the electron effectively 'feels' a greater attraction when the electron is in a lower energy level because the electron is closer to the nucleus. This is a widely accepted relationship, which is used with reference to integer energy levels as well as fractional energy levels.

5a-b. What is the basis for transitions involving fractional values of n and what are the conditions that will provide for said fractional transitions?

The existence of fractional values of n has been evidenced in detail above. Transitions of electrons between two energy levels is accepted scientific knowledge and is relevant to sub-ground energy levels in the same way as it is to integer levels.

5c-d. What is the basis for the increase in effective nuclear charge?

This is discussed above under point 4.

5e. How does one know that the radius of the electron path decreases and by how much will the radius decrease?

Since the human eye cannot 'see' an atom and the electron shells around that atom, those of ordinary skill in the art construct mathematical models which are in agreement with observations from experiments to determine the nature of the atom. It is accepted that more energy must be put into a system to remove an electron from a lower energy level compared with the amount of energy which must be put in to remove an electron from a higher energy level. This is because the electron exists closer to the nucleus and feels a greater attraction to the nucleus. It follows that the electron path decreases when an electron drops to a lower level, the amount by which it decreases being dependent on that lower level.

6a. What is the another system?

The other system is the catalyst. The passage referred to by the outstanding Office Action states that the other system acts as a receptor site for the energy emitted upon transition. The description teaches that the catalyst absorbs the energy emitted upon transition.

6b-c. What is close proximity?

Close proximity is achieved when the catalyst is mixed with the electrolyte and the catalyst particles disperse throughout the electrolyte. The particles must be close enough to interact, and the separation can be, for example, up to 2 or 3 mm apart.

6d. What is meant by a 'receptor site'?

The energy emitted when the hydrogen electron decays to the lower energy level is absorbed by an electron in a catalyst particle. This catalyst electron is excited to a higher energy level. The receptor site is the electron in the catalyst.

6e. How does one determine the 'exact energy quantum' for a given atom?

The exact energy quantum, in the case of hydrogen, is $mx27.2\text{eV}$. The specification demonstrates on pages 7 and 8 how this is calculated, based on the potential energy of the reduced radius energy state.

6f. How does one verify that the transition has occurred?

It is known that the transition has occurred since energy is emitted from the system.

7. What are the 'favorable' conditions?

As stated in the written description, the catalyst should be able to absorb $mx27.2\text{eV}$. A transition from $n=1$ to $n= \frac{1}{2}$, or from $n= \frac{1}{2}$ to $n=1/3$ emits 27.2eV and so the catalyst must be capable of absorbing 27.2eV . Greater amounts of energy can be obtained if an electron drops to a non-adjacent level, for example the transition $n=1$ to $n=1/3$. In this case, the catalyst must be able to

absorb $2 \times 27.2\text{eV}$, namely 54.4eV . The catalytic system is favorable if the catalyst is capable of absorbing 54.4eV .

8a. What is meant by the ‘ a_0 state’?

On page 5, a_0 is defined as the Bohr radius. This is terminology which is accepted in the field, and it refers to the radius of the ground state. The ‘ a_0 ’ state is therefore the ground state, and this is also accepted terminology in the field.

8b. What causes the hydrogen atom to emit the energy?

As disclosed in the specification, the energy is emitted when an electron decays to a sub-ground energy level. As discussed above in point 1, this occurs when the hydrogen atom collides with a catalyst particle.

8c. Why would the effective nuclear charge increase to $+2e$?

This is discussed in paragraph 4 above.

9a. What is meant by ‘catalytic transfer of energy’?

This phrase merely refers to the process in which an electron in the catalyst is excited to a higher energy level, thereby absorbing the energy, before returning to its lower energy level, thereby releasing the energy.

9b. What is meant by ‘restabilisation to the force balance’?

The phrase should read ‘restabilisation of the force balance’, and this has been corrected. Applicant respectfully submits that the person skilled in the art would instantly recognize this as an obvious error, and that the new wording therefore does not change the scope of the phrase. It is known that, in a non-radiative state, the kinetic energy of the electron in the orbit must exactly balance the electrostatic attraction between the electron and the proton in the nucleus. This is the

force balance. As described at the top of page 7, a new equilibrium for the force balance is established when the hydrogen electron drops down to the lower energy level.

9c. What are the conditions to allow catalytic transfer and restabilisation of the force balance?

Catalytic transfer will occur when a catalyst is capable of absorbing the energy emitted by the hydrogen atom, as discussed above and throughout the description. Restabilisation of the force balance occurs automatically when the electron enters a lower energy level.

9d. How does one know whether said catalytic transfer and restabilisation have occurred?

Further to paragraph 6f above, it is known when catalytic transfer has occurred because energy is emitted by the system. An electron will only decay to a stable energy level, and in a stable energy level the forces are balanced. Accordingly, if energy is emitted due to the transfer of an electron to a lower energy level, the energy balance of that level is stabilized.

10. The disclosure allegedly does not provide adequate support that rubidium, titanium and potassium catalyze the transitions.

The description teaches that potassium and rubidium ions are capable of catalyzing the reaction. The specific embodiment described on page 13 to page 18 uses an aqueous solution of potassium carbonate to provide potassium ions in the electrolyte. The positive results obtained when using a potassium catalyst are shown in the table spanning page 15 and page 16. Further, Dr. Riley's report also describes experiments which use potassium carbonate in the electrolyte. The description on page 9 also shows Rubidium to be capable of catalyzing the reaction since its second ionization energy is 27.28eV.

11. US 5,635,038 (Patterson-1) and US 5,607,563 (Patterson-2) are patentably distinct from the claimed inventions

Both the Patterson references teach an electrolytic cell operated in such a way as to obtain standard electrolysis. In particular, Patterson-2 states that an applied voltage of 5V is used to achieve electrolysis. Patterson-1 is silent as to the magnitude of the applied voltage, but the person of ordinary skill would understand that this is in the region of 1-5V, since the reference relates only to standard electrolysis. The references are not configured to apply a greater voltage, to generate a plasma discharge in the electrolyte. There is no teaching in either reference of generating a plasma discharge. Furthermore, the cited references do not teach the specific combination of voltages, catalysts and catalyst concentrations which have been introduced into the main claims of this application, which will be discussed in more detail below. Accordingly, contrary to the outstanding Office Action, Patterson-1 and Patterson-2 are not identical to the Applicant's systems and are not operated in an identical manner.

Accordingly, Applicant respectfully submits that he has shown that the invention is useful within the meaning of 35 U.S.C. § 101. "To violate [35 U.S.C. §] 101 the claimed device must be totally incapable of achieving a useful result." See Brooktree Corp. v. Advanced Micro Devices, Inc., 977 F.2d 1555, 1571 (Fed. Cir. 1992). "Situations where an invention is found to be 'inoperative' and therefore lacking in utility are rare, and rejections maintained solely on this ground by a Federal court even rarer." (M.P.E.P. § 2107.01 (8th ed. August 2001).) Given the data achieved by the Applicant, the invention is indeed capable of achieving a useful result. Contrary to the assertions in the Office Action, Applicant believes he has set forth a full example of the specific parameters of an operative embodiment. (See Specification at 14-16.) For the reasons discussed above, Applicant also respectfully submits that he has overcome the rejections under 35 U.S.C. § 112, first and second paragraphs.

Applicant therefore respectfully requests withdrawal of the rejection of claims 2-4, 6-19, 22, 24-26, 28-29, 31-32 and 36 under 35 U.S.C. §§ & 112, first and second paragraphs.

II. THE CLAIMS CONTAIN PATENTABLE SUBJECT MATTER

The Office Action further rejected claims 2-4, 6-19, 22, 24-26, 28-29, 31-32 and 36 under 35 U.S.C. § 102(b) or § 103(a) as anticipated by or unpatentable over Omori, Kubota, Yamazaki and/or Van Noorden. These rejections are respectfully traversed for the reasons discussed below.

Independent claims 2 and 36 recite that the catalyst is one of rubidium ions or potassium ions and having a concentration of between 1 mMol and 20mMol. The use of rubidium or potassium ions as the catalyst is disclosed on page 9 and the concentration range is described at lines 24 to 25 of page 3 of the published international application, and is covered in original Claim 27. Additionally, the voltage applied across the electrodes is recited as between 50V and 20,000V.

The use of a catalyst concentration of 1 to 20mMol, and the application of a voltage of between 50V and 20kV goes against the teaching of the prior art. Nevertheless, the combinations of all the features of claims 2 and 36 provide methods of energy release that are particularly efficient and therefore commercially advantageous.

The Applicant submits that rubidium or potassium ions are particularly effective in catalyzing the transitions of hydrogen and/or deuterium atoms to a sub-ground energy state. In the application as filed, titanium was also suggested as a catalyst. However, when titanium is dissolved into an aqueous solution, it does not exist as the Ti^{2+} species to a sufficient concentration to efficiently catalyse the transition. Therefore, titanium is less effective than potassium and rubidium ions.

As the applied voltage is increased from 50V, the amount of energy released increases. However, as the applied voltage is increased towards 20,000V and, more particularly, above 20,000V, the applicants have found that it is much more difficult to safely manage these very high voltages and the energy produced. At voltages above 20,000V, additional steps must be taken in preparing and monitoring the apparatus to ensure that the system operates reliably and safely. Implementation of these steps requires additional resources which reduces the overall efficiency of the system to the extent that the method of energy generation is no longer commercially viable. Accordingly, the applicants have appreciated that an upper voltage limit of 20,000V is advantageous.

Similarly, rubidium and potassium catalyst concentrations falling within the claimed range are particularly efficient in catalyzing the reaction in the voltage range of 50V to 20kV. Greater catalyst concentrations result in increased conductivity in the electrolyte and the voltage and current flow characteristics are less suited to the mechanism of this invention. Carrying out the method of this invention using a catalyst concentration which falls within the claimed range produces an amount of energy which can be efficiently harnessed. Accordingly, implementing the invention using catalyst concentrations outside the claimed range is not as efficient.

In view of the above, Applicant respectfully submits that the present invention provides a method of energy generation which can be carried out safely and efficiently so as to make the method commercially advantageous.

The outstanding Office Action objects that the claims of this application lack novelty over JP 3/150494 (Omori-1), JP 3-68894 (Omori-2) or JP 2-275397 (Kubota). Another reference, namely WO 90/14669 (Haeffner), has been cited by the European Patent Office Examiner. Comments are therefore provided below in respect of the Haeffner reference.

The method taught in Haeffner essentially involves the acceleration of D^+ ions towards deuterium atoms and molecules to cause a high energy collision that results in the fusion of two deuterium nuclei. In a first embodiment described at page 3 line 9 to page 4 line 17, the method is carried out by providing a tank containing heavy water and having a cathode and an anode located therein. A high voltage, which, according to Claim 3 of the application, is preferably more than 20kV, is applied across the electrodes resulting in the generation of an electrical spark between the two electrodes. The discharge produces deuterium ions which are accelerated towards the cathode where they form deuterium atoms or molecules. As further deuterium ions are accelerated towards the cathode they collide with the deuterium atoms and molecules resulting in fusion. In a second embodiment, described from line 19, of page 4, a further anode is provided. A voltage of between 2 and 12 volts is applied across the cathode and the second anode causing continuous electrolysis so that the cathode is continuously saturated with deuterium atoms and molecules. In this second embodiment, the reference also teaches the addition of an acid, such as D_2SO_4 , or an alkali-deuteroxide, such as LiOD or KOD, to the electrolyte. The reference gives no indication as to why these compounds are added to the electrolyte. The concentration of the dissolved substances is given as about 0.1M, though the reference teaches increasing the effective density by suspending magnetic particles in the electrolyte.

The reference does not disclose the use of rubidium ions in the electrolyte. Nor does the reference teach a concentration of potassium ions or rubidium ions in the electrolyte of between 1mMol and 20 mMol. Further, Haeffner does not disclose the application of a voltage across the electrodes of between 50V and 20,000V. Accordingly, the method defined in claims 2 and 36 are novel over the disclosure in Haeffner.

Applicant also submits that the claimed method is inventive over the teaching in Haeffner. Haeffner teaches the use of voltages of more than 20,000V. In the mechanism taught in Haeffner, a greater voltage results in increased acceleration of the deuterium ions towards the cathode, which in turn increases the probability of fusion of deuterium nuclei. There is no motivation at all in Haeffner for using a voltage other than that taught by the reference, and particularly, for using a voltage of between 50V and 20,000V. Indeed, the skilled person would consider that lowering the voltage would lower the probability of fusion. Accordingly, the person skilled in the art, having regard to Haeffner, would not consider it obvious to limit the applied voltage to the voltage range claimed.

Further, Applicant respectfully submits that it is not obvious in light of Haeffner to provide an electrolyte having a concentration of between 1 mMol and 20mMol of rubidium or potassium ions therein. Applicant respectfully submits that the skilled person would learn from Haeffner that, when a particular apparatus construction is used, namely an electrolytic cell having two anodes and a cathode, an acid or an alkali-deuteroxide should be added to the electrolyte to a concentration of 0.1 M, or 100mMol. Given that the addition of these substances is specifically taught with respect to the second embodiment only, and not with respect to the first embodiment, the skilled person would understand that these substances should not be used in the first embodiment. Further, Haeffner specifically teaches three compounds which may be added to the electrolyte in the second embodiment, and no preference for one compound over the other of the compounds is given. Only one of these compounds would be capable of catalyzing the reaction in the present invention.

It can be seen from the above that the skilled person is led to understand that these compounds may or may not be added to the electrolyte depending on the physical construction of the apparatus, and that the compounds are therefore not essential to the underlying energy-releasing mechanism exploited in Haeffner. The reference therefore gives no encouragement to the skilled person to vary the concentration beyond that taught in the reference, namely 100mMol. Accordingly, Applicant respectfully submits that it would not be obvious to the skilled person to use rubidium or potassium ions in the electrolyte at a concentration which falls within the claimed range.

Kubota discloses a nuclear fusion device comprising a tank filled with heavy water. An anode and a cathode are immersed in the electrolyte and a voltage of between 30V and 2 million volts is applied across these electrodes. The reference teaches forming the cathode from titanium since titanium readily absorbs deuterium. This results in the titanium cathode being saturated in deuterium in the electrolytic cell. Further, the cathode should have a spherical, cylindrical or rod shape. By forming the cathode in this way, deuterium is absorbed into the surface of the cathode and is concentrated into the center of the cathode. The shape of the cathode results in a very high density of deuterium within the cathode. The distance between adjacent deuterium nuclei is therefore reduced, and the probability of a collision between these particles, and therefore the probability of fusion, is increased.

Kubota does not disclose the use of potassium or rubidium ions at a concentration of between 1mMol and 20mMol in the electrolyte. Additionally, the reference does not teach the specific voltage range 50V to 20,000V. Accordingly, Applicant respectfully submits that the method defined in Claim 2 is novel over the disclosure in Kubota.

Applicant also submits that Claim I is inventive over a combination of Kubota and Haeffner. Since Haeffner does not teach why an acid or alkali-deuteroxide is added to the electrolyte, let alone why KOD should be selected and added, the skilled person would see no reason for adding KOD to the electrolyte in Kubota. Further, as discussed above, the skilled person would understand from Haeffner that an acid or an alkali-deuteroxide is added to a system having two anodes and one cathode, and that the addition of such a compound is not appropriate in a system having a single anode and a single cathode. Since Kubota provides one anode and one cathode, it would not be obvious to the skilled person to add potassium deuteroxide to the electrolyte. Even if the skilled artisan did consider adding potassium deuteroxide to the electrolyte in Kubota (which Applicant does *not* admit), the artisan would add the substance to a concentration of 100mMol, and not to the claimed concentration.

Applicant also submits that it would not be obvious to the skilled person to limit the voltage applied across the electrodes to a maximum of 20,000V. Kubota teaches the use of up to 2 million volts. There is no suggestion in Kubota that limitation of the voltage to a much lower limit would be advantageous.

Accordingly, Applicant respectfully submits that it would not be obvious to the person skilled in the art to combine the teachings of Kubota and Haeffner to result in a method as defined in claims 2 or 36.

Omori also discloses a nuclear fusion producing apparatus. This apparatus has a tank containing an electrolyte of heavy water and a pair of electrodes. A pulsed high voltage is applied across the electrodes causing a plasma discharge. The plasma discharge results in a pressure wave within the electrolyte, and a pressure-isolating structural body is located around the electrodes to control the pressure generated by the plasma. The reference teaches that the

electrodes and/or the pressure-isolating structural body may be made from a metal having high adsorptivity of hydrogen, such as titanium, so as to accumulate deuterium atoms and ions thereat. In the method, deuterium ions are generated and accelerated towards the cathode for collision with deuterium atoms, causing fusion in the same way as discussed above with respect to Haeffner.

Omori does not disclose the addition of rubidium or potassium ions to the electrolyte to a concentration of between 1mMol and 20mMol. Further, the reference does not disclose the application of a voltage of between 50V and 20,000V across the electrodes. Applicant therefore submits that the claimed inventions are novel over Omori.

For the reasons given above with respect to the inventiveness of claims 2 and 36 in light of Haeffner and Kubota, Applicant respectfully submits that the claimed invention is also inventive over a combination of Haeffner and Omori. Applicant further submits that it would not be obvious to the person skilled in the art to use the claimed voltage range in the apparatus described in Omori. Omori does not disclose a suitable voltage. The skilled person considering the prior art as a whole would see that both Haeffner and Kubota describe the use of voltages above 20,000V, and Kubota discloses a voltage of up to 3 million volts. The skilled person would therefore learn that, in an apparatus such as that described in Omori, it is desirable to apply a voltage greater than 20,000V. It would therefore not be obvious to the skilled person to limit the applied voltage to the range 50V to 20,000V. Applicant therefore respectfully submits that the methods defined by claims 2 and 36 are inventive over a combination of the cited references.

Omori 2 discloses the same apparatus as that described in Omori 1, though the pressure-isolating structural body is absent. Applicant respectfully submits that claims 2 and 36 are therefore also novel and inventive over Omori 2.


Because none of the art of record discloses, teaches or suggests the invention recited in claims 2 and 36, claims 2 and 36 are patentable over the art of record. Claims 3, 6-19, 22, 24-26, 28-29 and 31-32, which directly or indirectly depend from claim 2, are patentable for the reasons discussed above and the additional features they recite.

Thus, Applicant respectfully submits that claims 2-3, 6-19, 22, and 24-26, 28-29, 31-32 and 36 define patentable subject matter over the prior art of record. Please charge any additional fees or credit overpayment to the Deposit Account of McAndrews, Held & Malloy, Ltd., Account No. 13-0017.

Date: June 14, 2004

Respectfully submitted,
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